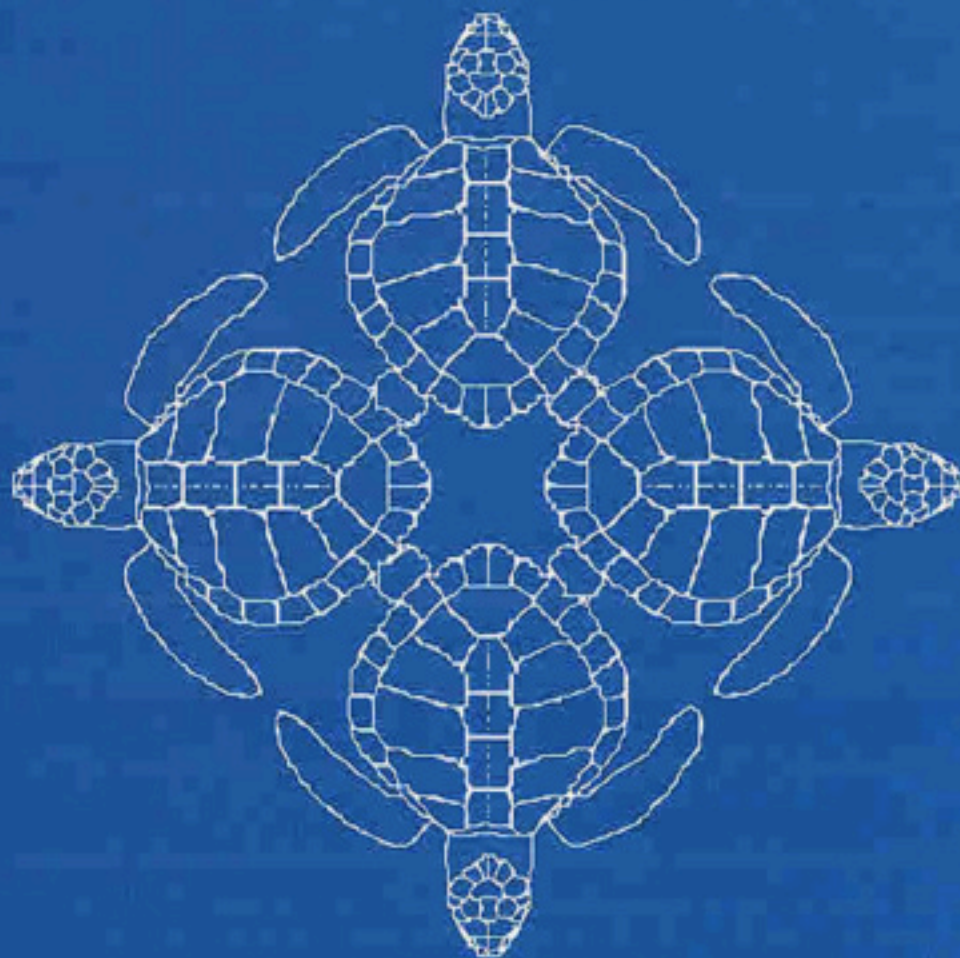




NOAA Technical Memorandum NMFS - SEFC - 259

GENERAL INFORMATION ABOUT SEA TURTLE RESEARCH AT THE NMFS GALVESTON LABORATORY



U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
Galveston Laboratory
Galveston, Texas 77551-5997

REVISED
APRIL 1991



**NOAA TECHNICAL MEMORANDUM
NMFS-SEFC-259**

**GENERAL INFORMATION ABOUT SEA TURTLE
RESEARCH AT THE NMFS GALVESTON
LABORATORY**

BY

Clark T. Fontaine, Jo A. Williams and Charles W. Caillouet, Jr.

**U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary**

**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
John A. Knauss, Administrator**

**NATIONAL MARINE FISHERIES SERVICE
William W. Fox, Jr., Assistant Administrator for Fisheries**

**REVISED
APRIL 1991**

This Technical Memorandum series is used for documentation and timely communication of preliminary results, interim reports, or similar special-purpose information. Although the memoranda are not subject to complete formal review, editorial control, or detailed editing, they are expected to reflect sound professional work.

NOTICE:

The National Marine Fisheries Service (NMFS) does not approve, recommend or endorse any proprietary product or proprietary material mentioned in this publication. No reference shall be made to NMFS, or to this publication furnished by NMFS, in any advertising or sales promotion which would indicate or imply that NMFS approves, recommends, or endorses any proprietary product or proprietary material mentioned herein or which has as its purpose any intent to cause directly or indirectly the advertised product to be used or purchased because of this NMFS publication.

This report should be cited as follows:

**Fontaine, Clark T., Jo A. Williams and Charles W. Caillouet, Jr.
1991. General information about sea turtle research at the
NMFS Galveston Laboratory. NOAA Technical Memorandum
NMFS-SEFC-259, 9 p. (Revised April 1991)**

Copies may be obtained by writing:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

GENERAL INFORMATION ABOUT SEA TURTLE RESEARCH AT THE NMFS GALVESTON LABORATORY

The National Marine Fisheries Service (NMFS) Galveston Laboratory is located near the Gulf of Mexico on the upper Texas coast. All programs at the laboratory are aimed at providing scientific information for the management of shrimp and finfish fisheries and their habitats and for the conservation of protected species. Sea turtle research provides information necessary to prevent extinction of the seriously endangered Kemp's ridley and to understand the behavior and habitat requirements of the five sea turtle species that occur in the Gulf of Mexico.

Sea Turtle Head Start Project

This experiment is part of an international program aimed at preventing the Kemp's ridley sea turtle (*Lepidochelys kempii*) from becoming extinct. The Kemp's ridley, an endangered species, was once common in the Gulf of Mexico and northern half of the Atlantic Ocean. The species has declined in abundance primarily due to overexploitation by man but natural causes have not been eliminated as contributing factors.

As recently as 1947, an estimated 40,000 Kemp's ridley females nested in one day on the primary nesting beach near the village of Rancho Nuevo, in the state of Tamaulipas, Mexico located on the Gulf of Mexico approximately 320 kilometers south of Brownsville, TX. Today, fewer than 400 females come ashore to nest near Rancho Nuevo each nesting season from April through August. Scientists fear that the species will become extinct unless steps presently being taken are successful in preventing it.

Federal agencies of Mexico and the United States are confronting the threat of Kemp's ridley extinction with a major recovery program. The nesting beach near Rancho Nuevo is patrolled and protected during the nesting season each year. Eggs from nests that are found are relocated to artificial nest sites within protected corrals on the beach. Approximately 50 thousand hatchlings are produced and released from

these corrals each year and about 2,000 hatchlings, representing less than five percent of the total produced each year at Rancho Nuevo, are taken by Mexico's Instituto Nacional de la Pesca and the U. S. Fish and Wildlife Service for transfer to the NMFS facilities in Galveston for the head start experiment. In previous years, about 2,000 eggs per year were collected and transferred from Rancho Nuevo to the Padre Island National Seashore where they were protected and incubated by the National Park Service until hatched 50-60 days after they were laid. Surviving hatchlings were transferred to Galveston for head starting.

Because adult sea turtles are known to return to the same beach to nest repeatedly over a number of years, biologists theorize that hatchling turtles somehow become "imprinted" to the natal beach and return there as adults. Most of the eggs gathered for head starting have been incubated in Padre Island sand and the newly emerged hatchlings have been exposed to Padre Island sand and surf. Biologists hope that the brief exposure to sand and surf at Padre Island "imprinted" the turtles and that, following head starting, tagging and release, they will return to the Padre Island beach upon reaching the age for reproduction, thus establishing a new breeding colony. Other turtles have been exposed to the sand and surf at Rancho Nuevo before head starting.

Hatchlings transferred to the NMFS Galveston

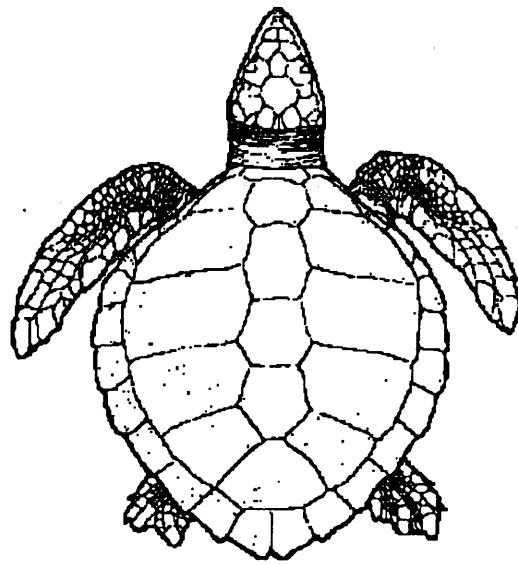
Laboratory are head started for 9-11 months in order to increase their survival during the first year of life. Survival during head starting is 90% or greater, whereas first-year survival in the wild is said to be less than 1%. In our facility, the turtles grow from approximately 16 grams to about one kilogram in 9-11 months.

The head start facilities consist of two greenhouse-like quonset huts, one small metal building and a large metal building. Turtles are reared in either concrete tanks or fiberglass raceways. Seawater is pumped from the Gulf of Mexico into fiberglass reservoirs and is heated during cold weather months. The turtles are fed a commercially prepared, dry, pelletized, floating sea turtle feed and the holding water is changed every other day.

Disease in head started turtles has been minimized by good husbandry practices and hygiene including control of temperature, food intake and seawater quality. Turtles that become sick are isolated in a sick-bay and treated upon advice of a veterinarian. Most sick head started turtles suffer from bacterial infections involving skin lesions and respond positively to routine antibacterial treatment.

Each sea turtle head started at the Galveston facility is tagged in three ways: (1) inconel metal flipper tag on the right foreflipper; (2) binary-coded magnetic-wire tag embedded in the flesh of the left foreflipper; and (3) living tag formed by grafting a light colored piece of the plastron tissue into the darker carapace. A fourth tag, the passive integrated transponder (PIT), which is a small microchip encapsulated in a one centimeter long glass tube, is being tried experimentally with head started turtles.

Most head started turtles have been released in the Gulf of Mexico offshore of Mustang and North Padre Islands, Texas with the objective of reinforcing any imprinting to Padre Island. Some head started turtles have been released offshore of Galveston, Texas, and Key West and



Kemp's Ridley Sea Turtle
Lepidochelys kemp

Homasassa, Florida and within selected bay systems on the lower Texas coast. A few have been released off the coast of Mexico. Vital information on their growth, survival and movements is obtained from those that are later caught or found and reported to NMFS.

Thousands of head started and tagged Kemp's ridley turtles have been released into the Gulf of Mexico since 1978. Data gathered so far indicate that the head started turtles adapt well to the wild. Some have been recovered from as far away as France and Morocco.

So far, none of the Kemp's ridleys head started, tagged and released since 1978 have been reported to have nested. Head starting will be considered completely successful only if the turtles reach reproductive age, retain their tags and return, to any beach, to nest.

A number of cooperative studies have been undertaken in conjunction with the head start project. The Department of Civil Engineering, Louisiana State University, Baton Rouge, LA

conducted a waste characterization study of the head start facility. A study in collaboration with Texas A&M University at Galveston, Department of Marine Biology, examined the effects of periodic exercise on swimming speed and stamina of head started turtles.

Two and three year old Kemp's ridleys head started at the Galveston Laboratory have been utilized in turtle excluder device (TED) certification tests conducted in the Gulf of Mexico near Panama City, Florida. Blood samples were collected both pre- and post-trawl and analyzed for pH, lactate, sodium, potassium, chloride, bicarbonate, total CO₂ and P_{co2}. Scientists from the University of Texas Medical Branch (UTMB) in Galveston are determining the physiological effects of submergence in trawls from such studies. Also in cooperation with UTMB, a study of genetic variation in Kemp's ridley and other sea turtles is being conducted using the methods of molecular genetics.

Gonads and kidneys are routinely excised from Kemp's ridleys that die during head starting so that sex of these turtles can be determined histologically. This provided information necessary for the National Park Service to determine the relationship between incubation temperature and sex ratio in Kemp's ridley. Additionally, DNA analyses of blood samples from live individuals were used to determine sex in Kemp's ridleys. This research was done by the Division of Reproductive Genetics, Department of Obstetrics and Gynecology, University of Tennessee, Memphis, TN.

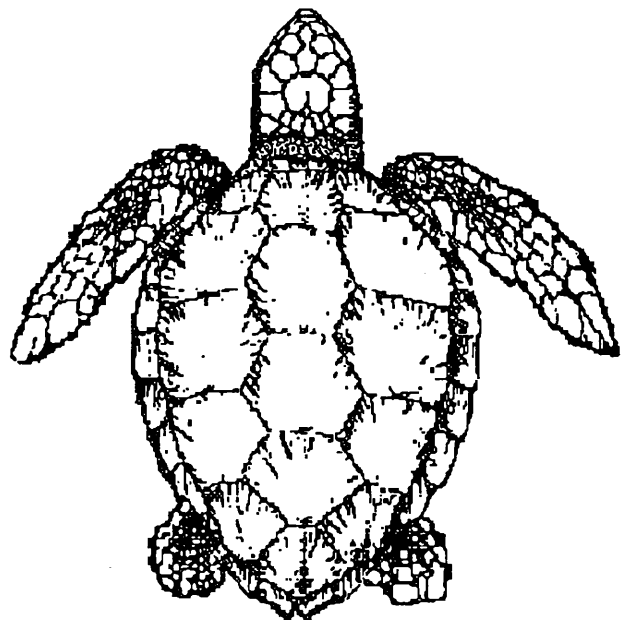
Wild sea turtles of any species that are found stranded alive, either injured or sick, are brought to the head start facility for rehabilitation. These animals have provided an opportunity for the head start staff and cooperating veterinarians to develop techniques for wound repair, disease diagnoses and treatment and general rehabilitation. Feces can be examined to determine food contents. Numerous sea turtles have been saved and returned to the environment after rehabilita-

tion.

Sea Turtle Stranding and Salvage Network

The Galveston Laboratory participates in the NMFS Sea Turtle Stranding and Salvage Network (STSSN), with a focus on the coasts of Texas and southwestern Louisiana. Systematic surveys of strandings are conducted on the Texas coast from the Rio Grande River to the Sabine River (excluding the Padre Island National Seashore covered by the National Park Service, and the Wynn Ranch covered by the U. S. Fish and Wildlife Service on Matagorda Island) and on the southwest Louisiana coast from the Sabine River to the Mermentau River.

Systematic beach surveys increase the chance that stranded turtles are found before they are redistributed by tides, destroyed by decomposition and carrion feeders, or mutilated or removed by man. Beaches are surveyed by



Loggerhead Sea Turtle
Caretta caretta

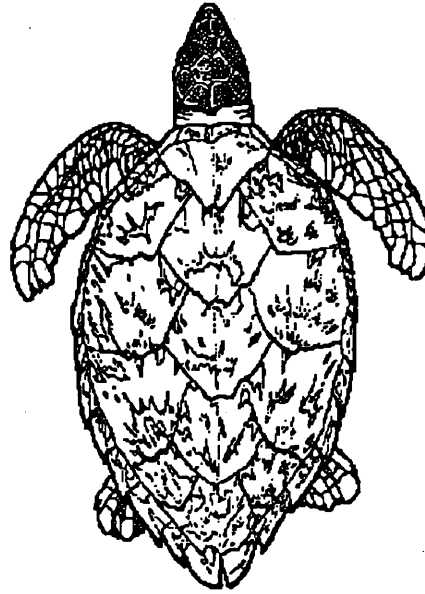
using 4-wheel drive vehicles, 4-wheel all-terrain-vehicles, or dirt bikes, depending upon remoteness and accessibility. In addition, reports of strandings from the public are responded to by Galveston Laboratory STSSN participants who collect the data and salvage the specimens.

Aerial surveys for sea turtle strandings are also conducted on the Texas coast. Surveys are made in conjunction with U. S. Coast Guard training flights and Coast Guard Auxilliary surveillance flights.

Systematic beach sampling surveys not only provide a means of quantifying the species, numbers and sizes of stranded sea turtles, but also provide valuable information concerning life history and possible causes of sea turtle mortality. The temporal-spatial distribution and habitat selection of sea turtles can be surmised from strandings in combination with information on ocean currents, stomach contents, and sessile organisms (e.g., barnacles, etc.) growing on their shells. The landfalls of stranded turtles most likely depend upon location where turtles were injured or killed, and if killed, how long it takes the carcass to swell with gas and float, as well as the direction and speed of prevailing surface currents that carry them to shore. Carcasses can also be redistributed by tides.

Sea turtle carcasses have been collected and necropsied by Texas A&M in hopes of determining probable cause of death. Necropsies also provide valuable biological data on sex, reproductive development and food habits. Despite these efforts, cause of death rarely can be determined from a stranded sea turtle carcass. Usually, there is too much tissue decomposition to firmly establish a cause of death.

After necropsy, some carcasses are saved and buried for later exhumation and curation for scientific and educational purposes and public display. For example, the long bones of sea turtles may be useful to studies of age and growth. Damaged or mutilated skeletons are



Hawksbill Sea Turtle
Eretmochelys imbricata

examined to determine causes of injury and death, and to confirm species identification. The carcasses are also of taxonomic value.

Systematic sampling surveys of sea turtle strandings are essential as one means of evaluating conservation and management measures such as mandatory use of TEDs, regulations concerning petroleum platform severance through Section 7 Consultations (under the Endangered Species Act) with Minerals Management Service (MMS), petroleum companies and their salvage contractors, and Section 7 Consultations concerning the impacts of U.S. Army Corps of Engineer's dredge-fill projects. Long time-series of data are especially important in this regard. The centralized STSSN data base for the entire southeast region goes back to 1980.

There is increasing government and public concern about the accumulation of dead or dying marine animals and man-made debris on our beaches. Besides being unsightly, marine debris poses a direct threat to marine life including birds, fish, sea turtles and marine mammals that either ingest or become entangled in such debris.

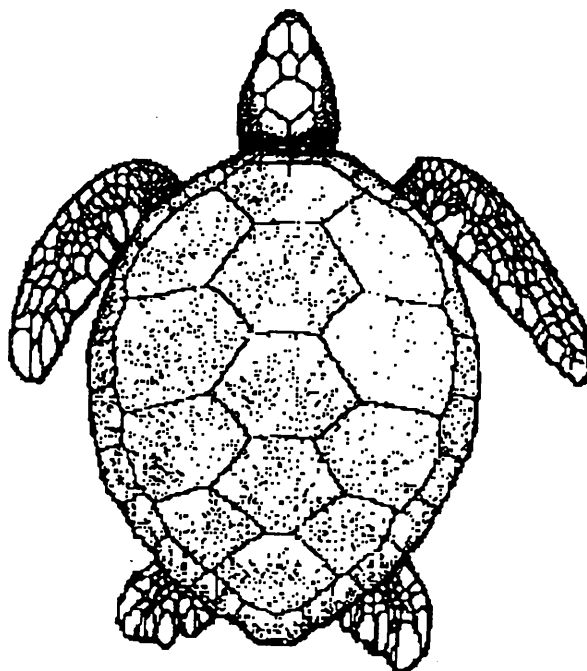
The Galveston Laboratory participated in marine debris sampling surveys and coastal cleanups along the coasts of Texas and southwestern Louisiana. Sea turtle carcasses necropsied by Texas A&M University provide information on harmful materials such as fish hooks and plastics found in the digestive tract.

Sea Turtle Behavior and Habitat Requirements

To better understand sea turtle life history, sightings and incidental captures (by-catch) of sea turtles are recorded and analysed. Incidental catch data files are maintained for head started-tagged Kemp's ridleys and wild turtles of all species. A sighting is an event in which a sea turtle is seen, usually swimming at the surface. Sea turtle strandings or turtles caught in trawls are excluded from this file. Some of the sightings are reported by divers belonging to dive clubs and some are reported by oil companies cooperating with the Galveston Laboratory or by NMFS observers during oil rig severance and salvage operations. Sightings are also made by other NMFS employees, and by boat operators, fishermen, and the general public.

The Galveston Laboratory collects information on sea turtle sightings from passes on the Texas and southwestern Louisiana coasts. "Sea Turtle Sighting Signs" have been erected at Calcasieu Pass, Sabine Pass, Galveston, San Luis Pass, Freeport, Port Aransas, Fish Pass, and Brazos Santiago Pass describing the different species of sea turtles that inhabit the Gulf of Mexico and explaining that numerous turtles have been sighted in the area. The signs request that beach goers, surfers and fishermen report any sea turtles seen around the jetties.

Another project involves attaching radio and sonic transmitters to juvenile and subadult sea turtles that have been stranded or caught alive from the inshore environment. After a period of



Green Sea Turtle
Chelonia mydas

rehabilitation, the turtles are released into the area from which they were collected and tracked for approximately 30 days. Data are collected on surface and submergence times, movement, habitat and environmental conditions, such as bottom type, aquatic vegetation type, salinity, and water and air temperatures. These data will help determine what habitats are important to sea turtles and to better understand their life cycles.

Another study is directed at determining the habitats utilized by hatchling sea turtles. Very little is known about the first years of a sea turtle's life, but it has been hypothesized that they utilize large floating mats of sargassum weed as shelter and as a source of forage organisms. Offshore cruises were conducted in to sample sargassum mats in the northwestern Gulf of Mexico. Diver observations, trawl samples and stomach content analysis of fish caught near the mats failed to produce any sea turtles.

Evaluation of Turtle Excluder Devices (TEDs)

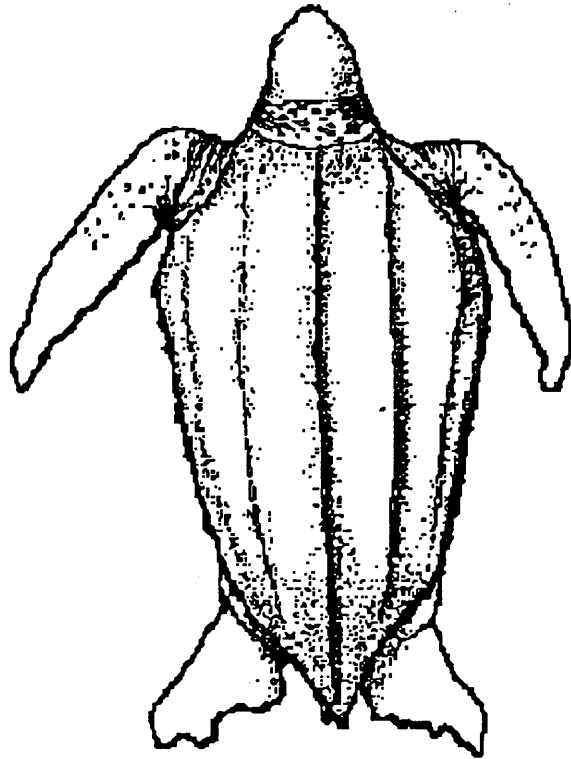
The National Marine Fisheries Service conducted a TED Evaluation Program in cooperation with the shrimp industry. Its overall objectives were to determine the catch rates of shrimp in TED-equipped trawls as compared to trawls without TEDs, in selected shrimp fishing areas of the south Atlantic and Gulf of Mexico, and to note incidental take of endangered and threatened sea turtles and marine mammals.

Oil and Gas Platform Removal

Offshore oil and gas structures in the Gulf of Mexico have been removed using underwater explosives. Such explosions can harm sea turtles or other marine animals. NMFS and Minerals Management Service (MMS) consulted under Section 7 of the Endangered Species Act. As a result, oil and gas companies wishing to use underwater explosives in federal waters are required to submit a permit application to MMS. Among the requirements of the permit is the use of qualified observers to monitor sea turtles and marine mammals around the platforms being salvaged and to suggest changes in operations to prevent harm to these animals.

Sea Turtle Satellite Tracking

Long term, detailed information on sea turtle movements, diving patterns, and habitat choice at sea can be obtained via satellite telemetry. The tags are fibreglassed to the carapace of the turtle. Objectives of this ongoing study are to: (1) describe the movements and dive patterns of sea turtles in relation to ocean currents and temperatures, (2) develop a biological model to explain and predict these behaviors and (3) describe the interactions between sea turtles and offshore oil and gas structures.



Leatherback Sea Turtle
Dermochelys coriacea

Cooperative Research

The NMFS Galveston Laboratory has collaborated and cooperated with a variety of scientists and institutions on research directed toward increasing the understanding of sea turtles. Chief among these are:

Help Endangered Animals -Ridley
Turtles (HEART)
Houston, TX

Houston Zoo
Houston, TX

Louisiana State University
Department of Civil Engineering
Baton Rouge, LA

Pan American University
Department of Biology

Edinburg, TX

Sea Arama Marineworld
Galveston, TX

Texas A&M University
Department of Biology
College Station, TX

Texas A&M University
Department of Marine Biology
Galveston, TX

Texas Veterinary Medical
Diagnostic Laboratory
College Station, TX

University of Texas Medical Branch
Department of Internal Medicine
Galveston, TX

University of Texas Medical Branch
Department of Physiology
and Biophysics
Galveston, TX

University of Texas Medical Branch
Department of Radiation Therapy
Biology Division
Galveston, TX

University of Texas Medical Branch
Marine Biomedical Institute
Galveston, TX

University of Texas
Marine Science Institute
Port Aransas, TX

University of Tennessee
Department of Obstetrics and Gynecology
Memphis, TN

SELECTED PUBLICATIONS¹

Caillouet, C.W., Jr., M.J. Duronslet, A.M.
Landry and E. Stabenau. 1988. Stockpiling sea
turtle carcasses. Marine Turtle Newsletter No.
42, p. 11-12.

Caillouet, C.W., Jr., M.J. Duronslet, A.M.
Landry, Jr., D. B. Revera, D.J. Shaver, K.M.
Stanley, E.K. Strabenau and R.W. Heinly. 1990.
Sea turtle strandings and shrimping effort in the
northwestern Gulf of Mexico, 1986-1989. MS
submitted to U.S. Fishery Bulletin.

Caillouet, C. W., Jr., D. B. Koi, C. T. Fontaine,
T. D. Williams, W. J. Browning and R. M.
Harris. 1986. Growth and survival of Kemp's
ridley sea turtle, Lepidochelys kempi, in captiv-
ity. NOAA Tech. Memo. NMFS-SEFC-186, iii
plus 34 p., 12 Tables and 7 Figures. (NTIS
Accession No. PB87-157350/AS)

Caillouet, C. W., Jr. and A. M. Landry, Jr.
(Editors). 1989. Proceedings of the First Interna-
tional Symposium on Kemp's Ridley Sea Turtle
Biology, Conservation and Management. Texas
A&M University, Sea Grant College Program,
TAMU-SG-89-105, vi plus 260 p.

Caillouet, C. W., Jr., S. A. Manzella, C. T.
Fontaine, T. D. Williams, M. G. Tyree and D. B.
Koi. 1989. Feeding, growth rate and survival of
the 1984 year-class of Kemp's ridley sea turtles
(Lepidochelys kempi) reared in captivity, p.
165-177. In: Caillouet, C. W., Jr. and A. M.
Landry, Jr. (Editors), Proceedings of the First
International Symposium on Kemp's Ridley Sea
Turtle Biology, Conservation and Management,
Texas A&M University, Sea Grant College
Program, TAMU-SG-89-105, vi plus 260 p.

Clary, J. C. III and J. K. Leong. 1984. Disease
studies aid Kemp's ridley sea turtle head start
research. Herpetological Review 15(3):69-70.

Demas, S., M. Duronslet, S. Wachtel, C.
Caillouet and D. Nakamura. 1990. Sex-specific

DNA in reptiles with temperature sex determination. *Journal of Experimental Zoology* 253:319-324.

Fontaine, C.T., M.J. Duronslet, D. B. Revera, T. D. Williams, J.A. Williams, S.A. Manzella, E.K. Stabenau, A.M. Landry, Jr., and C.W. Caillouet, Jr. 1990. Kemp's ridley head start experiment and other sea turtle research at the Galveston Laboratory: Annual report-fiscal year 1989. NOAA Tech. Memo. NMFS-SEFC-266, iv plus 28p. (NTIS Accession No. PB91-106971)

Fontaine, C. T., S. A. Manzella, T. D. Williams, R. M. Harris and W. J. Browning. 1989. Distribution, growth and survival of head started, tagged and released Kemp's ridley sea turtles (*Lepidochelys kempfi*) from year-classes 1978-1983, p. 124-144. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (Editors), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, Texas A&M University, Sea Grant College Program TAMU-SG-89-105, vi plus 260 p.

Fontaine, C. T., K. T. Marvin, T. D. Williams, W. H. Browning, R. M. Harris, K. L. W. Indelicato, G. A. Shattuck and R. A. Sadler. 1985. The husbandry of hatchling to yearling Kemp's ridley sea turtles (*Lepidochelys kempfi*). NOAA Tech. Memo. NMFS-SEFC-158, iv plus 34 p., 10 Tables, 22 Figures and 2 Appendices. (NTIS Accession No. PB85-241966)

Fontaine, C. T., T. D. Williams, S. A. Manzella and C. W. Caillouet, Jr. 1989. Kemp's ridley sea turtle head start operations of the NMFS SEFC Galveston Laboratory, p. 96-110. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (Editors), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, Texas A&M University, Sea Grant College Program, TAMU-SG-89-105, vi plus 260 p.

Heinly, R.W., E.K. Stabenau, A.M. Landry, Jr. and M.J. Duronslet. 1988. Frequency of mutilations in stranded sea turtles along the upper Texas coast, p. 33-34. In: Schroeder, B.A. (Compiler), Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Memo. NMFS-SEFC-214, 136 p. (NTIS Accession No. PB89-163083)

Klima, E.F., G.R. Gitschlag and M.L. Renaud. 1988. Impacts of the explosive removal of offshore petroleum platforms on sea turtles and dolphins. *Marine Fisheries Review* 50(3):33-42.

Klima, E. F. and J. P. McVey. 1982. Head-starting the Kemp's ridley turtle, *Lepidochelys kempfi*, p. 481-487. In: Bjorndal, K. A. (Editor). *Biology and Conservation of Sea Turtles*. Smithsonian Institution Press, Wash., D. C., 538 p.

Leong, J. K., D. L. Smith, D. B. Revera, J. C. Clary III, D. H. Lewis, J. L. Scott and A. R. DiNuzzo. 1989. Health care and diseases of captive-reared loggerhead and Kemp's ridley sea turtles, p. 177-200. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (Editors). Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, Texas A&M University, Sea Grant College Program, TAMU-SG-89-105, vi plus 260 p.

Malone, R. and M. Guarisso. 1988. Waste characterization study for the Kemp's ridley sea turtle. NOAA Tech. Memo. NMFS-SEFC-200, iv plus 38 p. (NTIS Accession No. PB88-205463/AS)

Manzella, S. A., C. W. Caillouet, Jr. and C. T. Fontaine. 1988. Kemp's ridley, *Lepidochelys kempfi*, sea turtle head start tag recoveries: distribution, habitat and method of recovery. *Marine Fisheries Review* 50(3):24-32.

Manzella, S., J. Williams, B. Schroeder and W. Teas. 1991. Juvenile head started Kemp's ridley

found floating in grass mats. Marine Turtle Newsletter No. 52, p. 5-6.

McVey, J. P. and T. Wibbels. 1984. The growth and movements of captive-reared Kemp's ridley sea turtles, Lepidochelys kemp, following their release in the Gulf of Mexico. NOAA Tech. Memo. NMFS-SEFC-145, 25 p., 3 Figures and 3 Tables. (NTIS Accession No. PB85-116390)

Plotkin, P. and A. F. Amos. 1988. Entanglement in and ingestion of marine debris by sea turtles stranded along the south Texas coast, p. 79-82. In: Schroeder, B. A. (Compiler), Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Memo. NMFS-SEFC-214, 136 p. (NTIS Accession No. PB89-163083)

Renaud, M., G. Gitschlag, E. Klima, A. Shah, J. Nance, C. Caillouet, Z. Zein-Eldin, D. Koi and F. Patella. 1990. Evaluation of the impacts of turtle excluder devices (TEDs) on shrimp catch rates in the Gulf of Mexico and south Atlantic, March 1988 through July 1989. NOAA Tech. Memo. NMFS-SEFC-254, 165p. (NTIS Accession No. PB90-267238/AS)

Shaver, D. J., D. W. Owens, A. H. Chaney, C. W. Caillouet, Jr., P. Burchfield and R. Marquez M. 1988. Styrofoam box and beach temperatures in relation to incubation and sex ratios of Kemp's ridley sea turtles, p. 103-108. In: Schroeder, B. A. (Compiler). Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Memo. NMFS-SEFC-214, 136 p. (NTIS Accession No. PB89-163083)

Stabenau, E.K. and T.A. Heming. 1989. Trawl stress in Kemp's ridley sea turtles. American Zoologist 29, 139A.

Stabenau, E.K., T.A. Heming and J.F. Mitchell. 1990. Respiratory, acid-base and ionic status of Kemp's ridley sea turtle (Lepidochelys kemp) subjected to trawling. Comparative Biochemis-

try and Physiology (in press).

Stabenau, E. K., M. King, A. M. Landry and C. W. Caillouet, Jr. 1988. Swimming performance of head started Kemp's ridley sea turtles, p. 113-117. In: Schroeder, B. A. (Compiler). Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Memo. NMFS-SEFC-214, 136 p. (NTIS Accession No. PB89-163083)

Stanley, K. M., E. K. Stabenau and A. M. Landry. 1988. Debris ingestion by sea turtles along the Texas coast, p. 119-121. In: Schroeder, B. A. (Compiler). Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Memo. NMFS-SEFC-214, 136 p. (NTIS Accession No. PB89-163083)

Weldon, P. J. and J. A. Williams. 1989. Rathke's glands: pattern of secretion discharge and tests of antipredator activity. American Zoologist 28(4):162A.

Wibbels, T. A. 1984. Orientation characteristics of immature Kemp's ridley sea turtles, Lepidochelys kemp. NOAA Tech. Memo. NMFS-SEFC-131, iv plus 67 p. (NTIS Accession No. PB84-220409)

¹Copies of NOAA Technical Memoranda can be purchased from:

National Technical Information Service
5258 Port Royal Road
Springfield, VA 22161

Copies of publications by the Texas A&M Sea Grant College Program can be purchased from:

Publications Office
Sea Grant College Program
Texas A&M University
4700 Avenue U
Galveston, TX 77551-5997

Copies of all other publications listed can be obtained from the author(s)